S·A·E JOURNAL

AUGUST 1932

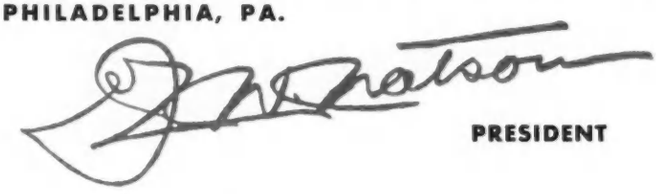
front springs give the answer

Front springs, soft enough to give a front-end period* of from 95 to 100, will at once do more for the comfort of the rear seat passengers than all else which has been done during the past twenty years of road, tire and shock absorber development and improvement.

Front springs, thus soft, will be made perfectly usable in combination with the infallible gyroscopic control resistance provided by the coming Watson Double-Acting GYRO Stabilators.

This new and revolutionary rear seat comfort is produced by the softer front springs—not by the shock absorbers. The proper caliber of shock absorbers, however, is necessary to make possible the use of such front springs.

JOHN WARREN WATSON COMPANY
PHILADELPHIA, PA.



PRESIDENT

GYRO

* The term "period" means the number of up-and-down movements per minute. To determine the period of the front end of any car, *disconnect the shock absorbers*, stand on the bumper, steady yourself by the radiator cap or lamps, throw your weight up and down swinging the front end of the car up and down with you. Then simply count the number of *down* strokes which take place during one minute. Choose a man weighing around 150 pounds to do this swinging. You hold the watch and do the counting. If the front end period is as high as 130, and you will probably find it so on most cars as built today, you may be certain that the rear seat passengers are getting "hell". With soft enough front springs you can knock that period down to around 95 or 100. The rear seat passengers will then get a taste of motoring heaven. To round out the perfect ride, the period for the rear end of any car should be around 75 to 80. This period is governed by the proper softness of the rear springs. (Read the GYRO advertisement in the July issue.)

S·A·E· JOURNAL

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CONTENTS

NOTE: Page numbers above that are preceded by (T) refer to the TRANSACTIONS section (between pp. 16 and 17 of the advertising and news section) containing papers and discussions that will be embodied in the volume of S.A.E. TRANSACTIONS for 1932, to be issued early in 1933.

The purpose of meetings of the Society is largely to provide a forum for the presentation of straightforward and frank discussion. Discussion of this kind is encouraged. However, owing to the nature of the Society as an organization, it cannot be responsible for statements or opinions advanced in papers or in discussions at its meetings. The Constitution of the Society has long contained a provision to this effect.

Renowned Speakers To Address Aeronautic Meeting

Superior Technical Program Announced for Cleveland Event This Month Includes Amelia Earhart as Dinner Speaker

VICE-PRESIDENTS William B. Stout and Charles L. Lawrance, together with their committees representing Aircraft and Aircraft-Engine Activities, have arranged a program of more than usual interest for the Society's Aeronautic Meeting that will be held at the Hotel Statler in Cleveland on Aug. 30 and 31, during the period of the National Air Races. Opening on Tuesday morning with a technical session at which vibration and stress-analysis methods will be discussed, the two-day meeting will include three engineering sessions and an Aeronautic Dinner; the latter to be held as usual in cooperation with the Aeronautical Chamber of Commerce of America. The assistance and support of our Cleveland Section will contribute largely toward the success of this important undertaking.

Starting with Vibration

C. J. McCarthy, chief engineer of the Chance Vought Corp., will introduce S. J. Zand, whose paper at the opening session will deal with the original work on vibration that has been extended since the presentation of Mr. Zand's paper at the Cleveland meeting last year. It will be recalled that this author was awarded the Wright Bros. Medal in 1931 on the merits of his paper entitled, Vibration of Instrument-Boards and Airplane Structures, which covered not only the theory of vibration but the practical applications of the vibrograph.

Included as the second paper of the opening session will be one of the finest works yet offered on the subject of stress-analysis methods—a presentation of Richard C. Gazley, of the Aeronautics Branch of the Department of Commerce. The industry will be greatly impressed by Mr. Gazley's treatment of Late Developments in Airplane Stress-Analysis Methods and Their Effect on Airplane Structures.

Propellers and Engine Indicators

Tuesday evening, under the chairmanship of Robert Insley, vice-president and general manager of the Continental Aircraft Engine Co., powerplants will be treated in two papers, one dealing with propellers and the other with engine performance. The development of hollow-steel propellers has occupied the attention not only of propeller manufacturers but of engine builders and users of aircraft for some time past. Considerable research and experimentation have resulted in unusual methods of manufacture and the subsequent development of propellers of this type, which, while still largely in the experimental state, seem to promise considerable advancement in terms of efficiency.

J. H. McKee, chief engineer of the Pittsburgh Screw & Bolt Co., has written a paper for this session on hollow-steel propeller blades, covering fabrication, research and performance, with special attention devoted to a comparison of such propellers with the older types now used.

The second paper of this session is on a subject of vital importance and great interest to aircraft-engine manufacturers; namely, the use of indicators as a means of improving aircraft-engine performance. Most engine designers are aware of the work

that is being done by Ford L. Prescott, of the Army Air Corps, at Wright Field. Through the cooperation of the Air Corps, the results of this project will be presented to the industry for the first time in Mr. Prescott's paper on this subject.

Two Papers on Transport Airplanes

The third technical session of the meeting, on Wednesday morning, will be devoted to transport-plane design. Capt. Frank Courtney, best known for his testing work on large transport planes, will handle the subject of design and testing. With the constant increase in air transportation, the development of economical, dividend-paying transport airplanes has become very vital to this branch of the transportation field.

Ralph Damon and George Page, respectively president and chief engineer of the Curtiss-Wright Airplane Co., have collaborated in the preparation of a paper on the Economic Aspects of Transport-Plane Design, which will be presented by Mr. Page. Engineers and executives of the transport companies will be greatly interested in these two papers as discussion of a practical problem.

All sessions of the meeting and also the dinner will be held in the main ballroom of the Hotel Statler on the mezzanine floor.

National Celebrities To Speak at Dinner

The dinner, climaxing the meeting, will again bring together leading aircraft members of the Society and the Aeronautical Chamber of Commerce of America, with the Cleveland Section of the Society cooperating in the arrangements. In preparing the dinner program, the Committee has arranged for speakers of prominence who not only have achieved great things but also are members of the Society.

The toastmaster needs no introduction, as the selection for this function is Major James H. Doolittle, holder of the transcontinental record and winner of the Bendix Trophy last year. The main address is to be delivered by Amelia Earhart, who has graced several similar events of the Society and is a Member of the Society.

The second address will be given by the Hon. David S. Ingalls, former Assistant Secretary of the Navy, a well-known Member of the Society and at present the Republican candidate for Governor of Ohio.

Reservations for the dinner should be sent to William G. Piwonka, Secretary of the Cleveland Section, who can be addressed at 19811 Sussex Road, Cleveland. Application blanks will be mailed to all those interested well in advance of the meeting.

As heretofore, no sessions have been scheduled for the afternoons; thus interference is avoided with attendance at the National Air Races, which this year promise to be bigger and better than ever. The meeting program in full is given herewith.

S.A.E. Cooperating in Metals Congress

Oct. 3, at Buffalo, To Be a Real Production Day, with Society Holding One of Many Sessions

THE Society is cooperating in the general program being arranged by the American Society for Steel Treating for the National Metals Congress in Buffalo during the week of Oct. 3, the Production Activity Committee having revised its original plan to hold the Annual Production Meeting this year during the National Machine Tool Exhibition at Cleveland in September, which was cancelled. After careful consideration by Vice-President Joseph Padgett, of the Production Activity; Chairman Joseph Geschelin, of the Production Meetings Committee; and Chairman Norman Shidle, of the National Meetings Committee, it was decided to limit the Annual Production Meeting this year to one good technical session as the Society's part in the cooperative program, in which a number of National organizations are participating.

Two Papers and Motion Pictures

The S.A.E. Production Session will be held in the Georgian Room of the Hotel Statler in Buffalo on Monday morning, Oct. 3. The program now being prepared for the session is to consist of two papers and the premiere showing of a motion-picture film of the production of high-grade die castings. One paper will deal with the design and performance of machine-tools and their equipment from the point of view of the engineer who designs the products to be made on those tools. The author will approach the subject from this perphaps somewhat new point of view, with the idea of adapting manufacturing equipment more to the product than of following the more usual practice of subjecting the design of the product to the ability of the machine-tool to make the product economically. When the manufacturing industries emerge more fully from present apathetic conditions, many new ideas will be introduced into both production equipment and methods.

The second paper planned will deal more specifically with recent advances in highly developed hard, fast-cutting materials of the type of tungsten carbide and their wider application in economical production. The possibilities for the still wider use of these materials, although discussed for some time, are beginning to extend beyond many of the limitations that have governed their use until recently. A number of new ideas that will be of real value to the production engineer are expected to be presented.

The motion pictures of the production of die castings will bring to those attending the meeting a visualization of the newest developments in this field. The development of alloys for die castings that are to be used in different classes of service where production quantities are sufficient to make the use of such castings economical, has opened possible ways of using die castings that will have many advantages to manufacturers in the automotive industry. Time will be provided for discussion of the papers and the picture.

Numerous Meetings of Other Societies

The S.A.E. and the American Society of Mechanical Engineers have cooperated in an effort to make Oct. 3 a real production day of the week. After an informal luncheon that probably will be arranged for jointly by the two Societies, it is expected that the A.S.M.E. will hold afternoon and evening sessions, at which papers of interest to the production engineers will round out the day's program. The National Metals Exposition at the 174th Regiment Armory will be open to visitors on the

afternoon and evening of Monday.

The program for the rest of the week provides for a number of technical sessions of the American Society for Steel Treating and for meetings of the other cooperating groups, which include the Institute of Metals and the Iron and Steel Division of the American Institute of Mining and Metallurgical Engineers, the American Welding Society and the Wire Association, as well as the S.A.E. and the A.S.M.E.

The officers and members of the Buffalo Section of the S.A.E. are cooperating with Chairman Geschelin, of the Production Meetings Committee, toward making our session on Monday morning one of great interest and real value to production men in all of the automotive manufacturing centers, many of whom are expected to attend the S.A.E. meeting.

Arrangements are being made by the A.S.S.T. for the distribution of reduced railroad-fare certificates to Buffalo and return for the members of the several Societies cooperating in the program of the week. Members of the Society who will plan to attend may obtain their certificates by applying to the New York office of the Society for them.

Transportation Men To Meet in Canada

Three Days at Toronto in Early October to Be Devoted to Varied Interests

THE 1932 Annual Transportation Meeting of the Society will be held at the Royal York Hotel in Toronto, Canada, Tuesday to Thursday inclusive, Oct. 4, 5 and 6. As in previous years, the Motorcoach and Motor-Truck Activity Committee is cooperating with the Transportation and Maintenance Activity Committee under the general guidance of Vice-Presidents B. B. Bachman and A. S. McArthur in the selection of topics and authors and in the arrangements of the program in general.

Five technical sessions are to be held, one each on Tuesday morning, Wednesday morning and evening and Thursday morning and afternoon. This arrangement will enable members coming from a distance to arrive in Toronto in time for the first session and to stay through the meeting for the closing session on Thursday afternoon before boarding the evening trains for their return.

Tuesday morning's session will be devoted to two papers, one dealing with the ventilation of motorcoach and motor-truck bodies and the other with the refrigeration of motor-truck bodies for the handling of perishable freight. The first speaker will present mainly the result of a survey now being made by a committee of which W. J. Cumming, the speaker, is chairman. The second subject will be presented by a man who has had wide experience in the field of transportation refrigeration.

Fleet Control and Legislation's Effects

Wednesday morning's session will be devoted to two papers and discussion on organized control of motor-vehicle transport operation and the development of increased transportation by motor-truck. In general, the first paper will point out ways for the more economical

(*Concluded on p.* 21)

Aeronautic Meeting Program

Hotel Statler, Cleveland — Aug. 30 and 31

TUESDAY, AUG. 30

Airplane Structures—10:00 A.M.

C. J. McCarthy, Chairman

Vibration of Instrument-Boards and Airplane Structures—**Stephen J. Zand,** Consulting Aeronautic Engineer.

Late Developments in Airplane Stress-Analysis Methods and Their Effect on Airplane Structures—**Richard C. Gazley,** Aeronautics Branch, Department of Commerce.

Powerplant—8:00 P.M.

Robert Insley, Chairman

Hollow-Steel Propeller Blades—**J. H. McKee,** Pittsburgh Screw & Bolt Co.

Indicators as a Means of Improving Aircraft-Engine Performance—**Ford L. Prescott,** Army Air Corps.

WEDNESDAY, AUG. 31

Transport Planes—10:00 A.M.

Luther Harris, Chairman

Transport-Plane Design and Testing—**Captain Frank Courtney,** Test Pilot.

The Economic Aspects of Transport-Airplane Design—**Ralph Damon** and **G. A. Page, Jr.,** Curtiss-Wright Airplane Co.

Aircraft Banquet—7:00 P.M.

Society of Automotive Engineers and Aeronautical Chamber of Commerce of America, with cooperation of Cleveland Section, S.A.E.

Major James H. Doolittle, Toastmaster.

Speakers—**Amelia Earhart** and the **Hon. David S. Ingalls.**

Many New Members Result from Get-Your-Man Campaign

Period of Awards Closed July 31 but Vigorous Efforts To Continue

HOPES and expectations have been largely fulfilled by the addition of many new members to the Society's roster during the six-months term of the Get-Your-Man campaign. It is believed that the interest taken and the time and effort expended in this enterprise have not been inspired primarily by the awards, but rather that they represent an earnest endeavor on the part of everyone to spread the advantages of the Society. The awards are badges of distinction rather than prizes of large monetary value.

On the stroke of midnight, July 31, new applications for membership in the Society ceased to count in the determination of the awards. This does not mean that Section Membership Committees and individual members have ceased the work of securing new members. On the contrary, many members and every Section of the Society will continue their efforts constantly to increase the membership and to bring to the Society present and future leaders in all branches of the automotive industry.

Many good men who are eligible for membership either are unfamiliar with the work of the Society or consider that membership is a rare privilege for which they must wait until invited to join. A continued effort is being made to find such men and extend the invitation.

Awards Announcement Later

Examination of applications and the election of applicants necessarily require time, and the Constitution of the Society provides that, subsequent to election, the elected member shall be allowed the maximum of 90 days within which to qualify by payment of his initiation fee and dues.

In view of the above factors, Dec. 31, 1932, has been set as the dead line for last arrivals of the campaign to qualify by payment of their initiation fee and dues.

All Sections and individual members that have secured applications therefore must see that the men whose applications they have sponsored send in their checks in accordance with these requirements to have them count in the awards. The individual and Sections awards are to be made on the number of applicants *elected and paid up.*

Individual and Section Awards

Awards will be made in two classes: (1) Individual National Awards; (2) Section Awards, both individual and group.

Individual National Awards

(1) To the member securing the *largest* total number of new members in the United States and abroad—Life membership in the Society

(2) To the member securing the *second* largest total number of new members in the United States and abroad—Three year's paid-up dues in the Society

(3) To the member securing the *third* largest total number of new members in the United States and abroad—Two year's paid-up dues in the Society

(4) To the member securing the *fourth* largest total number of new members in the United States and abroad—One years' paid-up dues in the Society

To the next highest ten—S.A.E. pins.

Section Awards

Individual.—To the member in each Section securing the largest number of new

(*Continued on p.* 21)

APPLICATIONS RECEIVED to July 25

From SECTIONS

(Expressed in Percentage of Quota)

Philadelphia	63.5
Northwest	62.5
Indiana	45.3
Baltimore	41.4
Canadian	38.0
Chicago	30.6
Detroit	29.1
Southern California	28.0
Kansas City	26.5
Metropolitan	22.6
Pittsburgh	20.9
Syracuse	15.5
New England	14.6
Washington	14.0
Buffalo	11.8
Wichita	11.8
Dayton	10.8
Milwaukee	10.7
Cleveland	10.1
Northern California	10.0
St. Louis	9.7
Oregon	0

From INDIVIDUALS

(Relative Standing Based on Number of Applications)

Tied for First Place

R. N. Dubois — John F. Hardecker

Tied for Second Place

L. V. Newton — O. M. Thornton

Third Place

P. J. Kent

Tied for Fourth Place

James B. Franks, Jr. — Reese Lloyd
A. Gelpke — C. C. Mathis
J. G. Holmstrom — C. C. Stewart

Tied for Fifth Place

C. H. Jacobsen — G. M. Pooley
L. R. Joslin — L. M. Porter

Tied for Sixth Place

F. K. Glynn — C. O. Richards
H. M. Jacklin — Alex Taub

HERE IS WHAT COUNTS!

New Members Obtained

(Elected and Paid Up July 25)

Section Standing

(Expressed in Percentage of Quota)

Canadian	20.7
Indiana	20.2
Philadelphia	13.4
Baltimore	12.8
Syracuse	12.1
Southern California	12.0
Chicago	10.5
Pittsburgh	10.5
Metropolitan	9.8
Detroit	9.4
Northwest	8.3
Buffalo	6.7
St. Louis	6.5
Dayton	5.4
Kansas City	4.8
Milwaukee	4.7
Cleveland	4.3
Northern California	4.0
Washington	3.0
New England	0.9
Wichita	0
Oregon	0

INDIVIDUAL STANDING

(For Individual Awards)

First Place

L. R. Joslin

Tied for Second Place

F. K. Glynn — L. M. Porter
R. N. Janeway — C. C. Stewart
C. C. Mathis — R. R. Teetor

Tied for Third Place

R. H. Combs — W. C. Keys
A. Gelpke — B. J. Lemon
J. G. Holmstrom — L. V. Newton
G. O. Pooley

"But What About Tomorrow?"

A. J. POOLE

S.A.E. Vice-President
Representing Diesel-Engine Engineering

SINCE the day when Gottlieb Daimler developed his gasoline engine, almost half a century ago, we have come to regard this type of motive power as the arbitrary standard of modern transport. Today, the possibilities of even greater engine simplicity and improved fuel performance are frequently subordinated to pressing administrative problems.

But what about tomorrow? The oil engine developed by Rudolph Diesel in 1897, and subsequently perfected to meet the needs of marine transport and large stationary powerplants, has shown a surprising adaptability to all the uses of land transport as well. Starting as a heavy, cumbersome unit, designed to move heavy masses, it has been refined and simplified until today it can be made to drive trucks, motor-coaches and tractors as well as 40,000-ton vessels.

There may be good reasons why the automotive industry cannot change over night from gasoline engines to the more economical oil-combustion engines. Engineering experience is a major problem; service is another.

But, the engineers in charge of automotive development will do well to keep an open mind and healthy curiosity about Diesel engines. The future will play no favorites. In the long run that type of engine will survive which requires the smallest number of service hours and covers the most miles per gallon of fuel.

Sincerely yours,

A. J. Poole.

Bendix Aviation Corp.

Chronicle and Comment

Our Society Today COMMENTING upon the Society's general well-being, President Scaife recently called attention to our sound financial position—the result, he said, of wise fiscal policies and the exercise of *suitable* operating economies. Savings in operation have been considered *suitable* only insofar as they could be applied without sacrificing important increments of return to the membership.

For example, downward adjustments in staff salaries have been in effect for months. Heavier-than-normal burdens have been assumed by key men and office workers, thus permitting an appreciable reduction in the size of our headquarters force. Improved procedure has been applied to the handling of office and field work and many economies have been instituted in routine activities. It should be added that our Sections have caught the spirit of the general organization and have succeeded in cutting unnecessary expense without impoverishing the returns to the membership.

It may not be generally known that the Society's income provides the average member with services which normally cost between two and three times as much as that member pays into the S.A.E. treasury. Part of the income that makes this possible—our advertising revenue—has fallen off as a natural consequence of subnormal economic conditions. So, the problem has been to maintain the essential services with a curtailed income.

For the substantial achievement of this aim, our President, his officers, councilors and committeemen deserve great credit. These leaders, guided by the conviction that depressed conditions are temporary, insist upon moving forward with undeviating faith in the Society's future. They firmly believe in continuing to provide the membership with every service and facility that can reasonably be expected. They are willing to dip into surplus funds to finance the accomplishment of these ends.

In line with these constructive tenets, the important features of S.A.E. activity are progressing vigorously; not under the cloud of depression, but in the bright sunlight of optimism.

Successful Get-Your-Man Campaign Closes THE SPIRIT of cooperation and the genuine interest that the members always have evidenced in connection with meetings, committees, research and the Society's affairs in general has again been demonstrated in the campaign for new members that has just closed. In bringing the facts concerning the Society and its place in engineering affairs to the attention of the large number of executives and engineers in all lines of automotive activity who have applied for membership, the members have once more shown their belief in their organization and its work.

Although July 31 marked the end of the campaign, so far as applications that can be considered in making the awards are concerned, it is certain that those who have been so active in this membership work, and many others as well, will carry on the endeavor continuously to bring into the Society those who are eligible.

Aeronautic Meeting in Cleveland This Month THE AERONAUTIC Meeting of the Society will again take its place among the outstanding events being held in Cleveland concurrently with the National Air Races. It is to be held at the Hotel Statler on Aug. 30 and 31, and will present an extremely interesting technical program, concluding on the second night with the joint Aircraft Dinner of the Society, the Aeronautical Chamber of Commerce and our Cleveland Section. Details of the program are given on p. 13 of this issue.

Production Day in Buffalo MONDAY, OCT. 3, will be a gala day for production men, who will be attracted to Buffalo by the Society's Production Meeting and other important events of that week. Advance information regarding our Society's part in the meeting is to be found on p. 12 of this issue. The cooperation of our Buffalo Section will be an important factor in the meeting's success.

An extremely interesting week of sessions in conjunction with the National Metals Congress will result from the coordinated activities of our Society and others concerned with the metals industry.

Canada to Welcome Transportation Men ENGINEERING aspects of legislation and regulation will receive much attention, along with many other technical problems that will be capably discussed, when our transportation men foregather in Toronto early in October for the General Transportation Meeting. Plans for the meeting, as announced on p. 13 of this issue, reveal a well-balanced ration of vital material that assures a lively event. Members of our Canadian Section are cooperating.

New Handbook Pages Being Issued STANDARDS COMMITTEE Division reports approved by the Committee and the Council at White Sulphur Springs in June will soon be issued in pamphlet form, arranged so that the individual sheets can be inserted in the proper places in the 1931 and 1932 editions of the S.A.E. HANDBOOK.

Highway Users Organize MORE THAN 50 important groups, including associations of operators and individual users of motor-vehicles, were represented at a meeting of the newly organized Highway Users Conference recently held in the City of Washington. Alfred P. Sloan, Jr., temporary chairman, indicated one important purpose of the Conference to be the development of equitable bases of taxation for the use of public highways and the elimination of unjust burdens of taxation upon highway traffic. It is the intention to coordinate the efforts of important groups interested in the objects of the conference and to gather and disseminate pertinent facts that should form the basis for just taxation.

In view of the influence of engineering factors upon a proper solution of taxation problems, our Society has been invited to become affiliated with the Conference.

Standardization Progress

Progress on F-W Lubricants

Classification by Viscosity Numbers Approved for Trial Before Final Adoption

BY approving for trial a classification of free-wheeling lubricants by viscosities, as proposed in a report submitted by the Lubricants Division, the Standards Committee and the Council took a distinct forward step at the Summer Meeting at White Sulphur Springs in June.

The status of the classification is that of General Information issued for trial by the automotive and petroleum industries, with the understanding that the whole subject will be reviewed again by the Lubricants Division before further action on it is taken by the Society early next year. The intention is that the classification, or such modification of it as seems desirable, shall be considered for adoption as S.A.E. Recommended Practice at the Annual Meeting in January, 1933, if and as approved by the Division.

History of the Project

The first step toward the formulation of a classification for this type of lubricants was taken in May, 1931, by a number of automobile manufacturers with the cooperation of several oil companies. A recommendation was submitted to the Lubricants Division in November and considered at a joint meeting of the Division and Subcommittee XXVII of the American Society for Testing Materials' Committee D-2 on Petroleum Products. At that meeting the recommendation was approved for publication as proposed recommended practice but, as the result of further consideration, it was subsequently modified for publication and discussed at a joint meeting of the Committees together with the Committee on Methods of Test and Specifications of the American Petroleum Institute at the City of Washington in January, 1932. As a result of the Washington conference, a compromise classification was published in the February, 1932, issue of the S.A.E. JOURNAL for information and trial, with the understanding that if possible a definite classification would be submitted for approval and adoption at the S.A.E. meeting in June.

The development in this period of a classification of free-wheeling lubricants has been of much importance to the automobile manufacturers and a troublesome problem to the petroleum refiners. With the different free-wheeling devices in use and the necessity of making them operate under a wide variety of climatic conditions, the automobile manufacturers have had to meet a serious problem in avoiding trouble to the car owners. This has tended to emphasize some of the difficulties of furnishing these lubricants.

However, continued cooperative effort of the automotive and petroleum industries and further experience with the classification now issued are expected to result in a classification by S.A.E. Viscosity Numbers which will be officially adopted, as similar classifications were adopted for crankcase oils and transmission and rear-axle lubricants. The present classification is published herewith to give it wide publicity and further trial before it is reconsidered by the Lubricants Division, probably in November or December of this year. It is as follows:

Free-Wheeling-Transmission Lubricant Viscosity Numbers

The viscosity numbers for free-wheeling-transmission lubricants constitute a classification in terms of viscosity and of consistency at low temperatures only. Other factors of quality or character are not considered.

Free-wheeling-transmission lubricants shall be properly refined, and free from water, sediment or any other substances detrimental to the proper performance of the lubricant. Fillers or abrasives such as talc, pulp, cork, fuller's earth, graphite, mica and asbestos are not permissible. Saponifiable oils or compounds derived therefrom are not excluded unless their use causes the lubricant to fail to meet other requirements. Lubricants that have an artificial viscosity are not permissible.

The Saybolt viscosity at 210 deg. fahr. shall not be less than the values given in Table 1 for the corresponding gravities, and the Saybolt viscosity at 100 or 130 deg. fahr. shall not be greater than the values given in Table 2 for the corresponding viscosities at 210 deg. fahr. Lubricants whose viscosities are outside the ranges of viscosities at 210 deg. fahr., as shown in Table 2, are not permitted under these viscosity numbers. Values between the minima and maxima for each viscosity number not shown in Tables 1 and 2 shall be determined by interpolation.

Free-wheeling lubricants of the extreme-pressure type shall meet the viscosity requirements of Tables 1 and 2. They shall be designated by the letters E.P.

These lubricants shall not channel in service when used at the following temperatures:

CHANNELING TEMPERATURES

Viscosity Number	Maximum Channeling Temperature, Deg. Fahr.
80 F. W.	−10
90 F. W.	0
110 F. W.	+10

Notes and Uses.—The Saybolt viscosity is influenced by the specific gravity of the lubricant under test, and a correction factor must be applied to reduce the Saybolt viscosities to the same absolute values. The Saybolt viscosities given in Table 1 are based upon absolute viscosities of 3.96, 11.24 and

TABLE 1—VISCOSITY—GRAVITY VALUES

80 F. W.						
A. P. I. Gravity at 60 Deg. Fahr.	31.14	28.39	25.72	23.14	20.65	18.24
Specific Gravity at 60 Deg. Fahr.	0.870	0.885	0.900	0.915	0.930	0.945
Minimum Saybolt Viscosity at 210 Deg. Fahr.	42	42	42	41	41	41
90 F. W.						
A. P. I. Gravity at 60 Deg. Fahr.	29.30	27.49	25.72	23.99	22.30	20.65
Specific Gravity at 60 Deg. Fahr.	0.880	0.890	0.900	0.910	0.920	0.930
Minimum Saybolt Viscosity at 210 Deg. Fahr.	72	71	71	70	70	69
110 F. W.						
A. P. I. Gravity at 60 Deg. Fahr.	28.39	26.60	24.85	23.14	21.47	19.84
Specific Gravity at 60 Deg. Fahr.	0.885	0.895	0.905	0.915	0.925	0.935
Minimum Saybolt Viscosity at 210 Deg. Fahr.	142	140	138	137	135	134

TABLE 2—RANGE OF VISCOSITY REQUIREMENTS

80 F. W.		90 F. W.		110 F. W.	
Actual Saybolt Viscosity at 210 Deg. Fahr.	Maximum Saybolt Viscosity Permitted at 100 Deg. Fahr.	Actual Saybolt Viscosity at 210 Deg. Fahr.	Maximum Saybolt Viscosity Permitted at 130 Deg. Fahr.	Actual Saybolt Viscosity at 210 Deg. Fahr.	Maximum Saybolt Viscosity Permitted at 130 Deg. Fahr.
41	167	69	320	134	1,113
42	177	70	325	135	1,116
43	188	71	330	136	1,119
44	198	72	335	137	1,122
45	209	73	340	138	1,125
46	219	74	345	139	1,128
47	230	75	350	140	1,131
48	240	76	355	150	1,159
49	250	78	365	160	1,187
50	260	80	375	170	1,215
51	270	85	400	180	1,243
52	280	90	425	190	1,272
53	290	95	450	200	1,300
54	300	100	475		
55	310	105	490		

Note.—This classification does not distinguish between lubricants that do not contain saponifiable oils or compounds derived therefrom, and lubricants that do contain such oils or compounds, because it is felt that the data available at this time are insufficient for such separate classification.

25.20 centipoises at 210 deg. fahr. respectively for the different viscosity numbers.

The viscosity of the lubricant at the slipping temperature is a function of viscosity and of viscosity index. The maximum Saybolt viscosities at 100 or 130 deg. fahr., corresponding to the actual Saybolt viscosities at 210 deg. fahr. given in Table 2, are arranged to permit using lubricants of all viscosity indexes that fall within the operating-temperature ranges covered by these viscosity numbers.

ATMOSPHERIC TEMPERATURES

Viscosity Number	Temperature, Deg. Fahr.
80 F. W.	above −15
90 F. W.	above +15
100 F. W.	above +40

Free-wheeling-transmission lubricants are intended and recommended for use under the following minimum atmospheric-temperature conditions:

Standard Chart for Relating Temperature to Viscosity

Rather closely related to the classifying of lubricants under a system of viscosity numbers is the need for a definite chart that will make possible the working out of many problems related to the change of viscosity of oils with changes in temperature. The Lubricants Division considered this subject some time ago but deferred action on it, as the A.S.T.M. Committee D2 on Petroleum Products was working on a standardized chart for this purpose.

After considering a number of charts developed by lubricant engineers, the Committee evolved a chart that was issued by the A.S.T.M. in April, 1932. This incorporates the best features of the charts previously used and is printed on sheets 16½ × 21½ in., either singly or in pads, with ranges in temperature from —30 to +450 deg. fahr. and in viscosity from 37 to 100,000,000 Saybolt Universal seconds. An accurate kinematic scale has been placed on the edge of the chart for the conversion of Saybolt seconds to fundamental viscosity units. Similar use can be made of these charts for other fluids, such as castor oil, glycerin, lard oil and coal-tar products, with good results. The S.A.E. Lubricants Division has endorsed the use of this chart, which can be obtained from the American Society for Testing Materials in Philadelphia in quantities at small cost.

Production Engineering

Heat-Treatment of Alloy Steels

Importance of Adequate Equipment and Correct Treatment Illustrated[1]

STRAIGHT carbon steel can be made stronger by correct heat-treatment than alloy steel is as it comes from the rolling mill or forge. This point is made clear by reference to Table 1, in which the properties of a carbon steel, a nickel steel, a low-nickel-chromium steel and a high-nickel-chromium steel are compared. Each of these steels has a carbon content of 0.40 per cent, and the heat-treatments are such as to produce approximately the same ductility or reduction of area in the pull test. In the annealed state, only the high-nickel-chromium steel is stronger than the heat-treated carbon steel. Also, much greater hardness can be obtained with the same ductility in the alloy steels.

TABLE 1—PROPERTIES OF SEVERAL STEELS, ANNEALED AND HEAT-TREATED

	S.A.E 1040		S.A.E. 2340		S.A.E. 3140		S.A.E. 3440	
	Annealed	Heat-Treated	Annealed	Heat-Treated	Annealed	Heat-Treated	Annealed	Heat-Treated
Tensile Strength, lb. per sq. in.	75,000	100,000	92,000	153,000	90,000	146,000	105,000	185,000
Yield Point, lb. per sq. in.	44,000	68,000	60,000	132,000	55,000	128,000	75,000	162,000
Reduction of Area, per cent	55	55	57	55	56	55	50	55
Elongation, per cent	32	32	28.5	20	30	18	20	18
Brinell Hardness No.	130	210	183	302	180	283	220	355

Microphotographs of S.A.E.-3140 steel are shown in Fig. 1, as forged; Fig. 2, after normalizing; and Fig. 3, after being quenched and drawn. From these we see that the heat-treatment not only increases the strength without great loss in ductility, but also gives a great decrease in grain size. It is an established fact that all metals break through cleavage planes of the crystals and not around the grain boundaries; therefore a fatigue crack in the steel shown in Fig. 3 could extend only approximately 1/50 as far as in the steel shown in Fig. 1 before reaching a grain boundary.

Any steel that contains large grains after forging or rolling should be normalized. Normalizing consists of heating to a temperature approximately 200 deg. above the upper critical point, holding at this heat for sufficient time and then cooling in air. This produces a uniform pearlitic or sorbitic structure. The steel can then be annealed at a much lower temperature to make the grain still finer, so that the steel will have the greatest possible resistance to fatigue.

Annealing or quenching steel at a "cherry red" is like trying to find the Hawaiian Islands in a small boat without a compass; a heat-treater without a pyrometer is like a sailor without a compass. If the "cherry red" is 200 to 300 deg. higher than the critical point of the steel, little will be gained by the annealing operation because of the rapid increase in grain size when a steel is soaked at such high temperatures. The correct annealing and approximate hardening temperatures of various steels can be found in many handbooks.

Double quenching is necessary to bring out the full properties of many carburizing alloy steels. As shown in Fig. 4, this consists of, first, heating the steel above the critical range of the core and quencing in oil, then reheating above the critical range of the case and quenching in oil or water, according to the physical properties desired in the case. The heating required for hardening the case is in reality a drawing operation for the core, leaving it in a fine-grained sorbitic state of high tensile strength and ductility.

Nickel retards the carburizing process, so it is often possible to quench the higher-nickel carburizing steels only once without excessive grain growth. In this treatment the hardening is done at a temperature slightly above the critical temperature of the case.

In general, according to R. R. Abbott[2], each 0.01 per cent of nickel increases the elastic limit of steel 40 lb. per sq. in., increases the tensile strength 42 lb. per sq. in.; increases the reduction of area 0.005 per cent and decreases the elongation 0.01 per cent. Nickel steels show higher impact values, which leads us to believe that nickel increases the toughness of steel. The nickel steels maintain a fine-grained pearlitic or sorbitic structure, when cooled slowly from the carburizing temperature, instead of

[1] Southern California Section paper by Richard S. Smith, General Metals Corp., Los Angeles.

[2] See *Proceedings of the American Society for Testing Materials*, vol. 17, part 2, 1917, p. 11.

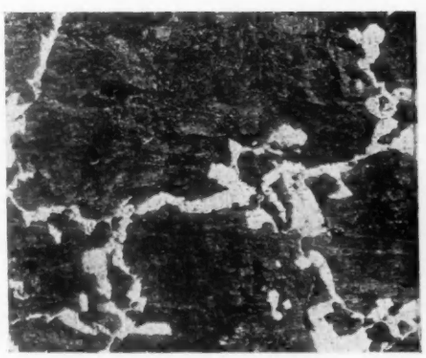


Fig. 1—As Forged

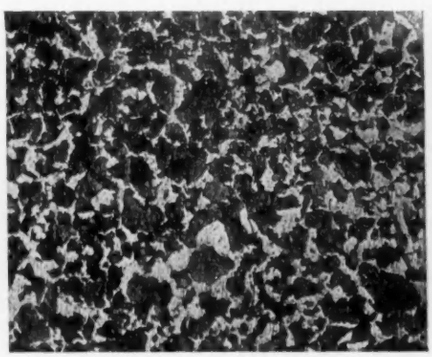


Fig. 2—After Normalizing

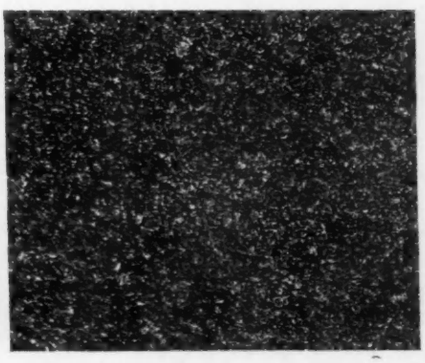


Fig. 3—After Being Quenched and Drawn

MICROPHOTOGRAPHS OF S.A.E.-3140 NICKEL-CHROMIUM STEEL, 100 TIMES SIZE

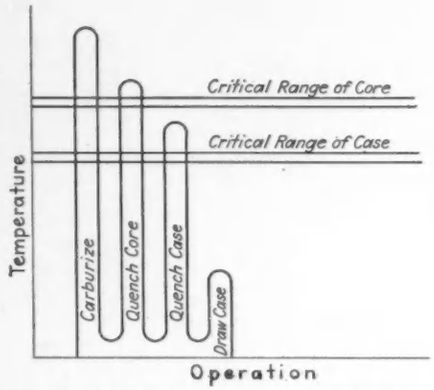


FIG. 4—HEAT-TREATMENT OF A CARBURIZING STEEL

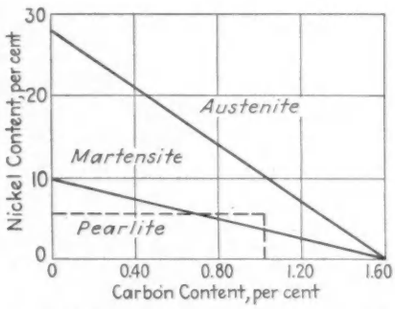


FIG. 5—DIAGRAM SHOWING NICKEL AND CARBON CONTENTS OF PEARLITE, MARTENSITE AND AUSTENITE

The Dotted Line Shows How Martensite Was Formed in Carburizing a 5-Per-Cent Nickel Steel

forming full lamellar pearlite structure.

Chromium accelerates the absorption of carbon; increases the elastic limit, strength and hardness; and decreases slightly the ductility. Chromium increases the susceptibility to hardening and the depth of penetration and raises the critical temperature.

Chromium-nickel steels apparently embody all of the good properties contributed by both alloying elements without the bad properties of either; hence their popularity for carburizing. Chromium-vanadium steels are little used for general carburizing purposes. The cost is high, and their only advantage is the property of absorbing carbon at slightly lower temperatures than the nickel steels.

Good Steel for Quantity Production

Manganese, although it increases the rate of carbon absorption, is commonly thought to render the case brittle. However, one of the finest carburizing steels for general use, of which I have used hundreds of tons recently, is of the following analysis, by per cent:

Carbon	0.18 to 0.25
Manganese	0.70 to 0.80
Silicon	0.20 to 0.30
Phosphorus	0.040 max.
Sulphur	0.045 to 0.060

Sulphur and manganese, maintained within these limits, give free machining properties to the steel without harmful effect. The manganese increases the dynamic strength of the steel, so it has been used very successfully for small crankshafts, connecting-rods and screw-machine parts, especially for electric refrigerators and air compressors, for which the parts are fabricated in automatic machines.

Nickel-molybdenum steel, S.A.E. 4615, is another steel that is coming into general use for case-hardening. Molybdenum apparently accelerates the absorption of carbon, forming a very fine iron-molybdenum carbide which gives free-machining qualities to the steel; a hard, tough case and an exceptionally fine-grained core.

An incident occurred several years ago which illustrates how access to charts can help in solving many problems. When I first began to carburize gears made of S.A.E.-2512 steel, nearly always there would be a soft layer on the surface a few thousandths of an inch thick. One of the good qualities of this steel is its low hardening temperature, which prevents the danger of decarburization and distortion. This soft case was not caused by decarburization, as it would work-harden with a few strokes of a file. The only constituent which could cause this condition was austenite, and reference to the chart reproduced in Fig. 5 shows that the carburizing of this steel, containing 5 per cent of nickel, produced martensite, which became austenite upon quenching. The only undesirable feature of a case of martensite-austenite is that the case becomes very brittle, although it will harden immediately with a few turns of the gears. The practice of producing a martensite case on small gears and then air-hardening them has been used when extreme accuracy after heat-treatment is required. The usual depth of such a case is 0.5 mm. (0.02 in.).

A great quantity of alloy steel is heat-treated at the steel mill, much of it being used for motor-truck axles. The Brinell hardness of such steel is usually between 227 and 250 and the tensile strength between 110,000 and 130,000 lb. per sq. in. One of the large steel mills has recently installed the most uptodate equipment obtainable for quenching and drawing alloy-steel bars. The furnaces are electrically heated and will handle bars from ¼ to 8 in. in diameter and 25 ft. long. They include a preheat furnace 5 ft. wide and 29 ft. long, from which the bars are passed automatically into the hardening furnace. When the bars are at the correct heat, they are removed from the hardening furnace automatically through the side, quenched and transferred to the drawing furnace. The hardening furnace is divided into six zones, each controlled by a recording pyrometer.

Good heat-treating equipment is much more essential than a thorough knowledge of such things as austenites, pearlites and alotropic changes, as most of these technicalities can be found in handbooks. A poor heat-treater can produce more reliable work with good equipment than can an expert with a wornout and broken-down furnace and an inaccurate pyrometer, which is worse than no pyrometer at all.

An alloy steel without correct heat-treatment is in no way as strong or as dependable as a correctly heat-treated carbon steel; for in heat-treatment there is strength.

News of the Sections

New St. Louis Section Officers

AT the June 7 meeting of the St. Louis Section, officers for the coming meetings season were elected as follows:

Chairman—A. O. Payne, president and general manager of Payne Products

Vice-Chairman—Joseph Conniff, general superintendent, People's Motorbus Co.

Treasurer—R. M. Pease, manager, St. Louis factory, Axelson Aircraft Engine Co.

Secretary—C. R. Marien, chief engineer, Ramsey Accessories Mfg. Corp.

Prescott To Be Dayton Chairman

OWING to the death of Gerhardt W. Frank, recorded on p. 22 in this issue of the S.A.E. JOURNAL, Ford L. Prescott, who was elected Vice-Chairman of the Dayton Section at the spring election in which Mr. Frank was elected Chairman, will serve as Chairman of the Section during the 1932-1933 Section year.

Transportation Men To Meet in Canada

(*Concluded from p.* 13)

and efficient operation of fleets, while the second will bear on the development of truck operating revenues.

Wednesday afternoon has been set aside to deal with present and prospective legislative regulation of motor-vehicles and the effect of such regulation on their design and operation. This probably is one of the most vital problems now facing operators of both motorcoach and motor-truck fleets. It will be handled in two sections, the first dealing more specifically with legislative regulation and the second with its effect upon the design and operation of vehicles and the resultant difficulties which have to be met in manufacturing vehicles for both intrastate and interstate operation under divers State regulatory requirements.

Engines, Fuels and Tires

Two subjects of first importance to all vehicle operators are scheduled for Thursday morning and will be presented by well qualified representatives in each field. A paper by Dr. Graham Edgar, of the Ethyl Gasoline Corp., will deal with modern automotive engines and their fuels. This subject is important from many angles to both the vehicle manufacturer and the operator. The second paper, to be presented by Burgess Darrow, of the Goodyear Tire & Rubber Co., will be a comprehensive review of recent developments in pneumatic tires, supplemented by a motion picture now being prepared especially for this presentation. Today's trends in pneumatic-tire design make this an especially interesting subject for valuable discussion.

Six-Wheel-Truck Design and Use

Austin M. Wolf, the author of several excellent papers presented before the Society, will give at the Thursday afternoon session a general review of six-wheel trucks and their uses in modern transportation. This subject has recently received considerable attention from the manufacturers, fleet operators and various regulatory bodies, and the discussion of this paper will be of direct interest to all those engaged in all three of these classes of occupation.

As a fitting climax to the whole meeting, the second paper of this session will deal with the business of motor-vehicle fleet operation. The man invited to present this paper has had wide experience in large-scale operation of motor-vehicles throughout the entire United States.

Transport Leaders To Meet at Dinner

The Transportation Dinner, at which the Canadian Section is to be host, will be held at the Royal York on Tuesday evening. The Section is planning a real dinner both as to the repast itself and the speakers. The messages to be delivered, in both serious and lighter vein, will be by men of long and wide experience in the general business of transportation. Guests at the dinner will constitute a group representing varied national interests of both the United States and Canada in different branches of transportation activities. Dinner tickets, at $3 per plate, should be purchased from the Society's offices in New York City. Application blanks and announcements will be mailed to interested members and guests well in advance of the dates selected for the meeting.

Arranging Plant Visits and Golf

As many who attend the Transportation Meeting probably will wish to visit some of the plants and garages in or around Toronto, the Transportation Meetings Committee is arranging through the Canadian Section for visits on Tuesday or Wednesday afternoon to the new Toronto Coach Terminal, the Davenport Garage and the Hillcrest Shops of the Toronto Transportation Commission and to the General Motors Corp. plant at Oshawa, about 30 miles east of Toronto. All who desire to make the visits should register for them immediately upon arriving at the Transportation Meeting, or previously if possible, as it will be necessary to arrange beforehand for transportation facilities to these plants.

The Meetings Committee also is arranging for the privilege of those attending the Transportation Meeting to play golf at the Royal York Golf Club on Tuesday or Wednesday afternoon. Transportation from the hotel to the golf club at definite times probably will be arranged for if a sufficient number indicate their desire to spend an afternoon at the club. These opportunities are expected to add much to the enjoyment of the meeting, as the weather early in October is most enjoyable in this part of Canada.

Many New Members Result from Get-Your-Man Campaign

(*Concluded from p.* 14)

members in his Section territory—Suitable prize to the approximate value of $20

Section Group Award.—A quota of new members has been assigned to each Section, this quota being based on the number of Section members and the average yearly number of applications received in the last three years from the Section territory.

An award will go to the Section securing the highest percentage of its quota of new members.

Board of Award

Recipients of the awards will be determined by the Committee on Rules and Awards appointed by the Council, as follows:

Edward P. Warner, *Chairman*
George W. Lewis
A. J. Poole
George O. Pooley
Alex Taub

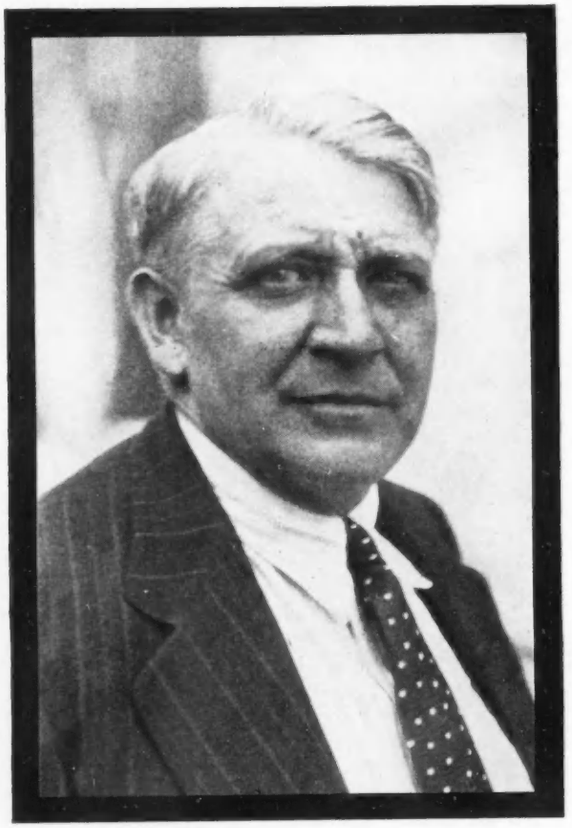
Frederick S. Duesenberg

FOLLOWING a fatal relapse from pneumonia contracted after having been injured in a recent automobile accident, Frederick S. Duesenberg died July 26. His passing will be mourned not only by all Members of the Society in which in past years he was so active, but by his hosts of personal friends and business associates who were attracted to him by his competent, loyal, genial and democratic personality. Known as a self-made man not possessing the advantage of technical university training, it is all the more remarkable that he exerted such a profound influence in the automotive industry in this Country through his knowledge gained by practical experience as a designer of racing cars and automobiles. Many of his racing-car data were later found invaluable in their influence on stock passenger-car design.

Born at Lippe, Germany, Dec. 6, 1876, Mr. Duesenberg came to this Country at an early age. Eventually he became proprietor of a bicycle shop and a builder of motorcycles. For the next several years he was employed in various capacities, and even spent one year in the retail business for himself; but in 1905 he organized the Mason Maytag Motor Car Co., at Waterloo, Iowa, and himself worked in the capacity of designer and superintendent. Five years later he was designer and mechanical engineer for this company. In this year, 1910, he was elected to Member grade in the Society.

In 1911 he became assistant manager for the Sears Automobile Co., Des Moines, Iowa, and held this position until 1915, when the Duesenberg Motor Co., St. Paul, Minn., was formed, Mr. Duesenberg being its manager. Upon the formation, in 1916, of the Duesenberg Motors Corp. to succeed the Minneapolis company, Mr. Duesenberg became chief engineer of the new organization, his brother, A. S. Duesenberg, being appointed assistant engineer. At that time the business was moved to Edgewater, N. J., and the following year another move was made, this time to Elizabeth, N. J. Beginning at this time, he served two years on both the Aeronautic and the Marine Divisions of the S.A.E. Standards Committee. When he came East in 1917, Mr. Duesenberg became a member of the Metropolitan Section of the Society, transferring his membership from this Section to the Indiana Section upon the organization of the Duesenberg Automobile & Motors Corp. of Indianapolis in 1919 with Mr. Duesenberg holding the position of chief engineer.

Mr. Duesenberg was appointed to the Engine Division of the Standards Committee in 1925. He was elected president of the Duesenberg Motors Co., Indianapolis, in 1926. He was Chairman of the Indiana Section in 1929, and represented the Section on the S.A.E. Sections Committee. For the last five years he was a member of the Stock Car Contest Advisory Committee of the Society, and in 1929 served as its Chairman. He was a Councilor of the Society since 1931, and, at the time of his death, was vice-president in charge of engineering for Duesenberg, Inc., Indianapolis.



FREDERICK S. DUESENBERG

As the author of numerous papers on the general subject of high-efficiency engines, as well as a frequent discusser of papers presented at meetings of the Society, Mr. Duesenberg exerted a further nation-wide influence in this Country. He was internationally known as an authority on racing cars. As an evidence of the high esteem in which his ability as a racing and automobile authority was held, the Test Board of the Automobile Association of America, during the 1927 Automobile Show in New York City, presented Mr. Duesenberg with a bronze tablet, upon which was inscribed:

In Appreciation of Fred S. Duesenberg

Racing is the crucible in which have been thoroughly tested many of the fundamentals of automotive engineering found in present-day automobiles. The race-track has been the stockroom of ideas for engineers of passenger-cars to which you have so graciously surrendered the key.

Fred Duesenberg was a *man*, as well as being an engineer possessed with genius. Modest, unassuming and always ready to give the other fellow a chance without taking undue credit for himself, his was an outstanding character that may never be replaced.

Gerhardt W. Frank

MEMBERS of the Dayton Section and his associates in the Army Air Corps at Wright Field, Dayton, Ohio, lament the recent death of Gerhardt W. Frank after an illness of only six days.

Mr. Frank, who became a Service Member of the Society in June, 1924, had been elected Chairman of the Dayton Section last spring, after serving as Secretary during the Section year 1930-1931 and as Vice-Chairman through 1931-1932. He entered the Government service in March, 1918, as an engine-dynamometer operator engaged in the development and testing of airplane engines and accessories in the engineering division of the Army Air Corps at McCook Field, and at the time of his death had been associate mechanical engineer in the powerplant branch of the Materiel Division at Wright Field since 1927. In October, 1921, he was transferred to the inspection division in the capacity of inspector in charge of experimental contracts and was stationed at the Packard Motor Car Co.'s plant and later at the Curtiss Aeroplane & Engine Corp.'s plant. During his spare time in 1920 and 1921 he designed and constructed a successful light sport plane. He was again transferred in August, 1927, to the powerplant branch, with the assignment of mechanical engineer, and from that time on devoted his time to the development of high-temperature liquid-cooled engines.

Mr. Frank was born at Springfield, Ohio, in 1896 and, after attending the public schools there and the Capital University Academy at Columbus, Ohio, studied the mechanical-engineering course of the International Correspondence Schools. In 1912 he entered the employment of the Robbins & Meyers Co., of Springfield, as an assembler of electric motors and successively was in the service of the Metallic Casket Co., of Springfield, as electrician; the Recording & Computing Machine Co., of Dayton, as production accountant; and the Quartz Spark Plug Co., of Dayton, as engineer.

(*Concluded on p.* 24)

Personal Notes of the Members

Sutton Joins Curtiss Company

Announcement was made in July that the Curtiss Aeroplane & Motor Co., of Buffalo, had engaged Harry A. Sutton as test pilot and research engineer. Since resigning from the United States Air Corps in 1929, Mr. Sutton has been vice-president and chief engineer of American Airways, a subsidiary of the Aviation Corp.

He entered the field of aviation in 1917 as a lieutenant in the Army, assigned to the aviation section of the United States Signal Corps, and spent a year as instructor at Kelly Field, San Antonio, Tex. Later he was transferred to the Materiel Division of the Air Corps at Wright Field, Dayton, Ohio, where he spent 10 years in the airplane branch. During this period he attended for a little more than a year the engineering school for Air Corps officers at the Massachusetts Institute of Technology.

Among the assignments given to Mr. Sutton at Wright Field was that of studying the phenomena of spinning, and he conducted many flight tests on numerous airplanes under various conditions of loading. The value of the published report on these tests has been widely recognized and, for his dangerous services in making them, Mr. Sutton was awarded the Distinguished Flying Cross by the War Department and also the Mackay Trophy.

Transoceanic Pilots Send Greetings

The following cablegram, dated at Rome, May 25, and signed by Balbo, the famous Italian airplane pilot, was addressed to and received by C. H. Schildhauer, of the General Aviation Mfg. Corp., of Dundalk, Md.:

The Transoceanic pilots assembled in Rome to put to the service of mankind their experience and their faith in the realization of quick and regular communication across the oceans, send their brotherly greetings to the far-away transoceanic companion, whom they feel near them, in remembrance of his great achievements.

The greetings of the international assembly of world-famous pilots were sent to Mr. Schildhauer in recognition of his accomplishment, as lieutenant-commander of the Dornier Do-X, in piloting the great 12-engined flying-boat from Germany to South America and thence to New York City.

P. E. Biggar, who was in charge of oil-engine development for Leyland Motors, Ltd., of Leyland, Lancashire, England, was recently appointed chief designer of the company.

M. P. Brooks, having given up his position as superintendent of equipment of the Pacific Freight Lines in Los Angeles, is now serving the Adohr Creamery Co., of the same city, as fleet manager.

R. C. Darnell was appointed chief engineer of the Handy Governor Corp., of Detroit, last month. He brings to his new connection an experience of many years in the automotive engineering field, as engineer with the Northway Motor division of the General Motors Corp., as engine engineer with Willys-Overland, Inc., and recently as chief engineer of the Taylor Sales Engineering Corp., of Elkhart, Ind.

Edward E. Dean, formerly research engineer with the Marvel Carburetor Co., of Flint, Mich., is now serving the Carter Carburetor Co., of St. Louis, in the capacity of carbureter engineer.

A. P. Eves has been appointed chief chemical engineer of Marquette Petroleum Products, Inc., of Chicago, to which he brings a thoroughly practical knowledge of lubricants and lubricating problems. He was associated for 25 years with the International Harvester Co., of Chicago, and, as chief chemist and metallurgist, had charge of tests and analyses that governed the recommendation of lubricants for trucks, tractors and maintenance equipment. As a member of the S.A.E. he served on the original Lubricants Committee.

Harry L. Ham has been made parts and service manager of the Albany, N. Y., zone of the Buick, Oldsmobile & Pontiac Sales Co. He formerly served the Olds Motor Works, of Lansing, Mich., in a similar capacity in the Boston zone.

Eugene Handler has sold his interest in the Witherbee Storage Battery Co. and resigned his position of president of the Lyons Storage Battery Co., of Belleville, N. J., and is now general manager of the Royal Battery Corp., of New Brunswick, N. J.

Mark Harris recently entered the service of the Alemite Corp., of Detroit, as a sales representative.

Walter M. Hartung, dean of aviation at Beckley College, Harrisburg, Pa., is temporarily serving in the capacity of aeronautic engineer for the Granville Bros. Aircraft, Inc., of Springfield, Mass., for the summer.

Alf Heum, formerly aeronautic engineer with the American Airplane & Engine Corp., of Farmingdale, N. Y., became associated in July with Metal Planes, Inc., of Detroit, in the capacity of chief engineer.

J. R. Howard, 3rd, is now working in the engineering research laboratory of the Ethyl Gasoline Corp., in Detroit.

R. W. Hoover, who was manager of the development department of the Mid-Continental Petroleum Corp., of St. Louis, recently assumed new duties as district representative in Utica, N. Y., of the Detroit Graphite Co.

W. B. Hurley began new duties last month as sales engineer with the Detroit Edison Co., of Detroit.

Russell E. Lawrence, formerly dean of engineering at the University of Detroit, has established and is president of the Lawrence Institute of Technology, in Highland Park, Mich.

Laurence S. LeGros has entered the service of the Scripps Motor Co., of Detroit, in the capacity of draftsman.

Clement V. McKaig was recently elected vice-president and general manager of sales of the Carnegie Steel Co., of Pittsburgh. He was formerly vice-president in charge of sales of the Great Lakes Steel Corp., in Detroit.

James Montanye, who was general service manager in Paris, France, of General Motors (France) S. A., is now serving the new Buick-Olds-Pontiac Sales Co., of Detroit, as parts and service manager in Albany, N. Y.

Alfred M. Ney has severed his connection as service manager with Smith & Gregory, of Long Island City, N. Y., and is now doing independent consulting engineering work at Lakeside, Mich.

A. M. Niven recently entered the service of the Chrysler Corp., of Detroit, in the capacity of draftsman. His former connection was with the Continental Aircraft Engine Co., also of Detroit, as assistant chief engineer.

Harold E. Reed is now serving the American Car & Foundry Motors, of Detroit, in the capacity of designer, having relinquished a similar position with the Chrysler Corp., of Highland Park, Mich.

Clifford E. Roberts has returned to the Glenn L. Martin Co., of Middle River, Baltimore, from his recent position of design engineer on military airplanes with the Consolidated Aircraft Corp., of Buffalo, and now has charge of the design group of the Martin company.

T. M. Robie, who formerly held the position of mechanical engineer in the Diesel-engine sales department of Fairbanks, Morse & Co., in Chicago, has been transferred to the Dallas, Tex., branch of the company, where he is manager of the engineering and construction department.

Charles Sardou, Jr., has been appointed to the position of inspector by the Boeing Airplane Co., of Seattle.

William R. Stroud has been appointed foreman of the truck-fleet maintenance shop of the Warner Bros. Co., of Philadelphia, which manufactures and distributes ready-mixed concrete. Before accepting this position he was general inspector for several years in the same organization.

Carl Voorhies, who was service engineer of the Pierce-Arrow Motor Car Co., of Buffalo, is now research engineer of the Wilcox-Rich Corp., of Detroit.

Milton H. Wells is now employed as sales manager of the oil-burner division of the Capitol Electric Co., of Indianapolis.

Applicants Qualified

The following applicants have qualified for admission to the Society between June 10 and July 11, 1932. The various grades of membership are indicated by (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate; (S M) Service Member; (F M) Foreign Member.

BIGAREL, CLIFTON C. (M) head electrician, automotive, Eastern Greyhound Lines, *Salina, N. Y.;* (mail) Malden Road.

BRETZ, ELLMAN O. (J) district manager, Tide Water Oil Sales Co., *Springfield, Mass.;* (mail) 55 Maple Street.

CHAMPION, HARRY M. (A) automotive engineer, Standard Oil Co. of New York, Albany, N. Y.; (mail) 97 West Ganse-voort Street, *Little Falls, N. Y.*

CLARKSON, ALICK (M) 210 Audubon Drive, *Snyder, N. Y.*

DOPPEL, LEONARD (M) engineer, Keystone Transportation Co., Inc., 1790 Broadway, *New York City.*

GIBSON, HAROLD J. (J) research engineer, Ethyl Gasoline Corp., 723 East Milwaukee Avenue, *Detroit.*

HARLEY, STANLEY J. (J) deputy managing director, Coventry Gauge & Tool Co. (1928), Ltd., Earlsdon House, *Coventry, England.*

HATCH, ERVIN N. (J) analysis engineer, Brooklyn Bus Corp., *Brooklyn, N. Y.;* (mail) 326 67th Street.

HIGGINSON, RICHARD HENRY (M) superintendent, Davis Tool & Engineering Co., *Detroit;* (mail) 14542 St. Marys Avenue.

HURLEY, WILLIAM B. (M) 321 Rivard Boulevard, *Grosse Pointe Village, Mich.*

JOYS, ROBERT BROWNELL (A) manager, New York branch, Heil Co., 31st Place and Star Avenue, *Long Island City, N. Y.*

KEESHIN, JOHN L. (M) president, Keeshin Motor Express Co., 1453 Washburn Avenue, *Chicago.*

KELLEY, EDWARD J. (A) president, Automotive Ignition Co., Inc., 4919 Baum Boulevard, *Pittsburgh.*

LERCH, BROOKE W. (J) 1015 Penn Avenue, *Wyomissing, Pa.*

MCALLISTER, JOHN T. (J) assistant research engineer, motor fuel and lubrication, Standard Oil Development Co., *Elizabeth, N. J.;* (mail) 758 Jersey Avenue.

MCMILLIN, ROBERT MILTON (M) laboratory assistant, Chevrolet Motor Co. Experimental Laboratory, *Detroit;* (mail) 296 Holbrook Avenue.

NIXON, STUART (M) sales representative, Continental Motors Corp., Detroit; (mail) 22 East 38th Street, *New York City.*

PAYETTE, JOSEPH A. (J) assistant field engineer, United States Rubber Co., Inc., 6600 East Jefferson Avenue, *Detroit.*

SCHAIRER, GEORGE SWIFT (J) student, Swarthmore College, Swarthmore, Pa.; (mail) 40 Elm Lane, *Bronxville, N. Y.*

SCHOMBURG, WILLIAM H. (M) vice-president, Bingham Stamping & Tool Co., *Toledo;* (mail) 1062 Post Street.

SCOTT, MAURICE (M) assistant superintendent, Department of Water & Power, City of Los Angeles, *Los Angeles;* (mail) 209 South Broadway.

SCOVILLE, ROBERT WAGONER (J) junior engineer, Chrysler Corp., *Detroit;* (mail) 16896 Linwood Avenue.

SHIPLEY, JEROME WILSON (J) installation department, Pratt & Whitney Aircraft Co., East Hartford, Conn.; (mail) *Bedford, Va.*

SIEBERT, GEORGE E. (A) superintendent of equipment, Division of Highways, State of California, *Sacramento, Calif.;* (mail) 1862 Fourth Avenue.

SMITH, E. F. (A) district superintendent, motor equipment, Gulf Refining Co., 600 Hurt Building, *Atlanta, Ga.*

SNIVELY, RICHARD K. (A) contact and copy executive, Stelle-Wessinger-Foltz, Inc., *Lancaster, Pa.;* (mail) 127 East Orange Street.

WARNECKE, CHARLES L. (J) junior engineer, Vacuum Oil Co., Paulsboro, N. J.; (mail) 693 St. Johns Place, *Brooklyn, N. Y.*

Obituaries

(*Concluded from p.* 22)

After joining the Society, Mr. Frank was greatly interested in its work, to which he devoted much time, energy and thought. He presented a paper at the Aeronautic Meeting in Cleveland in August, 1929, entitled High-Temperature Liquid-Cooling, which was published in the S.A.E. JOURNAL in October of that year and in TRANSACTIONS, Vol 24. He gave a résumé of the paper at the September meeting of the Dayton Section in the same year.

Carl B. Frevert

MANY of his friends and acquaintances in the tractor-engineering field regret the recent passing away of Carl B. Frevert, who had been active in tractor designing and engineering for 22 years, at the General Hospital in Denver. His last connection was with the Oliver Farm Equipment Co., of Charles City, Iowa, as assistant chief engineer, a position he had held since 1929, succeeding to that office from that of engineer of the Hart-Parr Co., which then became a division of the Oliver company.

Mr. Frevert was a native of Iowa, having been born at Adebolt, in that State, in 1888. He was graduated from Iowa State College in 1911 with the degree of Bachelor of Science in Mechanical Engineering but had established his connection with the Hart-Parr Co. two years earlier. From 1912 to 1914 he was engaged with the M. Rumely Co., of La Porte, Ind. During the next year he did design work for the Emerson-Brantingham Co. in Columbus, Ind., and assembling and testing for the tractor works of the International Harvester Co. in Chicago. Next he returned to the Advance-Rumely Co. as designing engineer.

During the World War, Mr. Frevert served in the American Expeditionary Force as first lieutenant in the Ordnance Corps in France, following which he returned to the Hart-Parr Co. as tractor designer, later becoming engineer of the company.

Mr. Frevert was admitted to the Society in Member grade in 1917.

Charles J. McPherson

FRIENDS and acquaintances of Charles J. McPherson, sales manager of the J. G. Brill Co., of Philadelphia, who was widely known in railroad and automotive circles, were shocked to learn recently of his sudden death at the Congress Hotel in Chicago. He was on a business trip and is believed to have succumbed to a heart attack.

Mr. McPherson, who was admitted to Member grade in the Society in September, 1924, had devoted all of his business life to the locomotive and railroad-car industry and had been connected with the Brill company for nearly 20 years. He was a Kentuckian, born at Hopkinsville in that State in 1886, and was graduated by the University of Kentucky at Lexington in 1906, with the degree of mechanical engineer. In the same year he became an apprentice with the Baldwin Locomotive Works, of Philadelphia. From 1907 to 1912 he was a draftsman with the American Car & Foundry Co., of Berwick, Pa., and the following year became chief draftsman for the National Steel Car Co., of Hamilton, Ont., Canada. He joined the J. G. Brill Co. in 1913 as assistant chief draftsman and was progressively advanced to the positions of mechanical engineer, assistant superintendent, superintendent, sales manager of the automotive-car division and finally sales manager of the company.

Besides being a member of the S.A.E., Mr. McPherson was a member of the American Society of Mechanical Engineers, the Army Ordnance Association, the Railroad Club of New York, and the Art Club and Penn Athletic Club of Philadelphia.

Applicants for Membership

The applications for membership received between June 15 and July 15, 1932, are listed below. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

ARMSTRONG, JOHN A., farm hand, New York State Department of Agriculture, *Riverhead, N. Y.*

BENNETT, MERRILL, assistant in automotive engineering department, Purdue University, *Lafayette, Ind.*

BONFIELD, T. F., service manager, Lacy L. Redd & Co., Inc., *Philadelphia.*

CASE, ROBERT W., senior engineering draftsman, Naval Aircraft Factory, *Philadelphia.*

COLLENDER, GUSTAVE A., engineer and service manager, Six Wheels, Inc., *Los Angeles.*

DECKER, ARTHUR R., chief engine inspector, The Texas Co., *Norfolk, Va.*

DEPAOLO, PETER, sales promotion, DeSoto Motor Corp., *Detroit.*

DOYLE, THOMAS JOSEPH, service salesman and inspector, Reo Sales Corp., *Detroit.*

DUNNELL, JACOB, naval architect, Crowninshield Shipbuilding Co., *Fall River, Mass.*

FERNSLER, ROBERT PALMER, JR., draftsman, Naval Aircraft Factory, *Philadelphia.*

FOX, MILTON C., assistant experimental engineer, Wright Aeronautical Corp., *Paterson, N. J.*

FREYERMUTH, GEORGE H., engineer, Standard Oil Development Co., *Elizabeth, N. J.*

GARY, WRIGHT W., director of petroleum research, M. W. Kellogg Co., *New York City.*

GEIMAN, EDWARD W., superintendent of transportation, Fairfield Western Maryland Dairy, *Baltimore.*

GUSTAFSON, CARL A., chief engineer, road-machinery division, Caterpillar Tractor Co., *Minneapolis.*

HANSEN, LIEUT. HAROLD C., U.S.M.C. motor-transport officer, Marine Barracks, *Parris Island, S. C.*

HARA, YUTAKA, student, Massachusetts Institute of Technology, *Cambridge, Mass.*

HAY, GEORGE A., field engineer, Autocar Co., *Ardmore, Pa.*

HOARE, WILLIAM P., superintendent of repairs, Boeing Air Transport, Inc., *Cheyenne, Wyo.*

HUGHES, JAMES R., chief body engineer, Studebaker Corp., *South Bend, Ind.*

HURTUK, S. H., teacher, Board of Education, *Cleveland.*

JOHNSON, JOHN, owner, Motor Rebuild Shop, *Everett, Wash.*

JOHNSON, CAPT. RICHARD W., U.S.A., Holabird Motor Transport Depot, *Baltimore.*

JOHNSTON, GEORGE E., purchasing agent, Continental Motors Corp., *Detroit.*

KAMP, JOHN CLIFFORD, sales engineer, Holley Carburetor Co., *Detroit.*

KEMP, ARTHUR D., draftsman, Naval Aircraft Factory, *Philadelphia.*

KENNEDY, M. ROBERT, sales representative, Valentine & Co., *Chicago.*

KEYES, JOHN E., JR., sales engineer, Ethyl Gasoline Corp., *Baltimore.*

KINNUCAN, JAMES W., engine designer, Continental Motors Corp., *Detroit.*

LEAK, ARTHUR H., assistant engineer, Wright Aeronautical Corp., *Paterson, N. J.*

MAYER, WILLIAM G., president, Mayer Body Corp., *Pittsburgh.*

MCCLOY, ARTHUR S., district sales manager, Anaconda Wire & Cable Co., *Detroit.*

MCCULLOCH, JOHN ALEXANDER, general manager, J. A. McCulloch & Co., *Montreal, Que., Canada.*

METASAP CHEMICAL CO., INC., *Harrison, N. J.*

NISLEY, CAPT. HAROLD A., U.S.A., chief, automotive section, Ordnance Department, *City of Washington.*

NORMAN, E., general manager, A. L. Fell, *Chicago.*

PETERS, HAROLD M., fleet superintendent, Seattle Times, *Seattle.*

PILET, R., forge engineer, Fenwick S. A., *Paris, France.*

RABE, KARL, DR. ING., Porsche, G.m.b.H., *Stuttgart, Germany.*

ROCKELMAN, FRED L., president, Plymouth Motor Corp., *Detroit.*

SPARRE, GUSTAVE, draftsman, Consolidated Aircraft Corp., *Buffalo.*

SWEIGERT, RAY L., associate professor of mechanical engineering, Georgia School of Technology, *Atlanta.*

TAYLOR, JOHN B., JR., sales engineer, Ethyl Gasoline Corp., *New York City.*

TOBIN, BENJAMIN F., JR., treasurer, Continental Motors Corp., *Detroit.*

WADDELL, WILLIAM, designer, Continental Aircraft Engine Co., *Detroit.*

WADE, HAROLD P., body engineer, Chrysler Corp., *Detroit.*

WIERENGO, JOHN L., president, John L. Wierengo & Staff, *Grand Rapids, Mich.*

WILLIAMS, DUNCAN B., engineer, Carbide & Carbon Chemical Corp., *New York City.*

WOCKLEY, FRANK C., JR., manager, Allied Spring Service, *Pittsburgh.*

YOCOM, RICHARD H., engineer, draftsman, 955 Queen Street, *Pottstown, Pa.*

Notes and Reviews

AIRCRAFT

Weight Reduction versus Drag Reduction in Design. By K. D. Wood. Published in *Aviation Engineering*, March, 1932, p. 18. [A-1]

In this article a method is developed for determining how much weight may be added to an airplane when the drag is reduced by any given amount, assuming constant engine horsepower, flying speed and wing area. Examples are given of the application of the derived formulas to four specific airplanes, and the relationship between drag reduction and increase in cruising range for long-range airplanes is pointed out. The conclusion reached is that almost any reduction in drag justifies the necessary extra weight, although, with a legal or practical limit on landing speed, extra structural weight means either reduced useful load or larger wing area, and the advantage of drag reduction which requires increased weight is less.

Control Beyond the Stall. By G. V. Lachmann. Published in *The Journal of the Royal Aeronautical Society*, April, 1932, p. 276. [A-1]

The author reviews the developments in lateral stability and control of airplanes beyond the stall and outlines the less explored problems of longitudinal control beyond the stall. In conclusion, suggestions are made as to the way in which existing technique can be applied to produce a fully controllable spin-proof airplane capable of being landed in restricted areas.

The article is divided into the following sections: I—The General Problem, dealing with the schools of thought in regard to stalling and lateral stability and control in stalled flight; II—The Aerodynamic Characteristics of Wing-Tip Slots, covering derived slot lift curve and required slot span, wing-tip shape and methods of determining slot dimensions; III—The Improvement of Lateral Control beyond the Stall, including consideration of the spoiled automatic slot, interceptors and interceptor effects; IV—Spin-Proof Airplanes; V—Longitudinal Stability and Control in Stalled Flight, including a consideration of the causes of loss of elevator efficiency at large angles of incidence; and VI—Technique of Stalled Landings.

Tests of Nacelle-Propeller Combinations in Various Positions with Reference to Wings. Part I—Thick-Wing N.A.C.A.-Cowled Tractor Propeller. By Donald H. Wood. N.A.C.A. Report No. 415, 1932; 30 pp., illustrated. Price, 10 cents. [A-1]

Wind-Tunnel Research Comparing Lateral Control Devices, Particularly at High Angles of Attack. II—Slotted Ailerons and Frise Ailerons. By Fred E. Weick and Richard W. Noyes. N.A.C.A. Report No. 422, 1932; 16 pp., with tables and charts. [A-1]

Wind-Tunnel Tests of a Hall High-Lift Wing. By Fred E. Weick and Robert Sanders. N.A.C.A. Technical Note No. 417, May, 1932; 4 pp., 6 figs. [A-1]

Wind-Tunnel Tests of the Fowler Variable-Area Wing. By Fred E. Weick and Robert C. Platt. N.A.C.A. Technical Note No. 419, May, 1932; 6 pp., 12 figs. [A-1]

The Effect of Propellers and Nacelles on the Landing Speeds of Tractor Monoplanes. By Ray Windler. N.A.C.A. Technical Note No. 420, May, 1932; 12 pp., 17 figs. [A-1]

The Nature of Air Flow about the Tail of an Airplane in a Spin. By N. F. Scudder and M. P. Miller. N.A.C.A. Technical Note No. 421, May, 1932; 6 pp., 8 figs. [A-1]

The Aerodynamic Characteristics of a Model Wing Having a Split Flap Deflected Downward and Moved to the Rear. By Fred E. Weick and Thomas A. Harris. N.A.C.A. Technical Note No. 422, May, 1932; 7 pp., 17 figs. [A-1]

Entwicklung der Festigkeitvorschriften für Flugzeuge. By Hans Georg Küssner and Karl Thalau. Published in *Zeitschrift für Flugtechnik und Motorluftschiffahrt*, June 14, 1932, p. 313. [A-1]

Methods for making strength calculations for aircraft in Germany and other countries as developed from the beginning of aircraft technique to the present are here reviewed. The conception of the factor of safety is especially subjected to a critical examination.

A common characteristic of strength calculations is said to be the application of factors derived from older and tested forms of airplane to the new and more developed modern types. The fallacy of this practice, the authors point out, is that higher stresses are to be expected in the more efficient aircraft of today. They assert that fundamental stress studies must be undertaken if aircraft technique is not to antiquate to the point of uselessness the methods of making strength calculations.

Weitere Flugmessungen über die Wirksamkeit von Automatischen Handley Page-Schlitzquerrudern. By Wilhelm Pleines. Published in *Zeitschrift für Flugtechnik und Motorluftschiffahrt*, May 28, 1932, p. 287. [A-1]

The 1931 yearbook of the German institute for aeronautical research contained the first report of the operating characteristics of a Handley Page automatic slit wing as demonstrated on a German aircraft. The present technical note sets forth the results of further flight tests made on the same Albatross airplane, with an improved slit-wing construction designed especially for it. Improvements noted in flight characteristics at high angles of attack are said to be attributable to the Handley Page device.

Vertical Descent of the Autogiro. By J. A. J. Bennett. Translated from *Zeitschrift für Flugtechnik und Motorluftschiffahrt*, Vol. 23, No. 8, April 28, 1932. Verlag von R. Oldenbourg, München und Berlin. N.A.C.A. Technical Memorandum No. 673, June, 1932; 13 pp., 6 figs. [A-4]

Effect of the Ground on an Airplane Flying Close to It. By E. Tönnies. Translated from *Zeitschrift für Flugtechnik und Motorluftschiffahrt*, Vol. 23, No. 6, March 29, 1932. Verlag von R. Oldenbourg, München und Berlin. N.A.C.A. Technical Memorandum No. 674, June, 1932; 16 pp., 16 figs. [A-4]

Drop Forgings and Stampings. By W. A. Thain. Published in *Aircraft Engineering*, April, 1932, p. 96. [A-5]

The growth in recent years of drop forging and stamping is recognized as being fundamentally linked with the history of the development of high-speed transport.

The continuous growth of the motor-car and the mechanical-transport industry, with the consequent necessity for the adoption of mass - production methods by the manufacturer so as to meet normal production requirements, led to an ever-increasing appreciation of the repetition advantages of the drop-stamping process.

This article describes in detail the process of production of forgings and stampings for use in aircraft.

CHASSIS PARTS

Epicyclic Gearing. By W. G. Wilson. Published in *The Automobile Engineer*, March, 1932, p. 139. [C-1]

The author touches upon the historical side of the epicyclic gear, so far as vehicles are concerned, briefly enumerating the best-known types of such gears, with no attempt to describe them in detail. A broad reference is made to the new systems, indicating the dif-

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These items, which are prepared by the Research Department, give brief descriptions of technical books and articles on automotive subjects. As a rule, no attempt is made to give an exhaustive review, the purpose being to indicate what of special interest to the automotive industry has been published.

The letters and numbers in brackets following the titles classify the articles into the following divisions and subdivisions: *Divisions*—A, Aircraft; B, Body; C, Chassis Parts; D, Education; E, Engines; F, Highways; G, Material; H, Miscellaneous; I, Motorboat; J, Motorcoach; K, Motor-Truck; L, Passenger Car; M, Tractor. *Subdivisions*—1, Design and Research; 2, Maintenance and Service; 3, Miscellaneous; 4, Operation; 5, Production; 6, Sales.


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ferent lines of thought along which development may come.

A few points covering the case for the epicyclic-gear transmission are given, with a general outline of the aspect presented to the works engineer. Finally, the salient points in the design, divided into the gearing, various forms and combination of epicyclic gears for different purposes, the brake and its theory, automatic adjustment, selector and spring control, are explained with the aid of diagrams.

ENGINES

The Northey Rotary Engine. By L. Mantell. Published in *The Automobile Engineer*, April, 1932, p. 175. **[E-1]**

The author points out that in the development of the internal-combustion engine as we know it today many ideas have been proposed for solving the problem of dealing with this form of energy conversion by purely rotary means. Most of these have been nebulous. Recently, however, a serious and, according to Mr. Mantell, a very promising research has been conducted in England.

The method of approach in the case described has not been along turbine lines as usually understood by that word. On the contrary, these researches have been aimed at direct conversion of explosive energy into mechanical work by virtue of the same pressure and expansion laws that obtain in reciprocating-engine practice; the whole of the combustible hydrocarbon, coal gas or similar fuel being burned inside the engine and transformed into useful work without the agency of the slider crank chain or valve mechanism such as we usually associate with an internal-combustion engine. The Northey engine is completely and essentially a rotary, and very definitely not a turbine engine, in the usually accepted sense of the latter word.

Service Function of Pistons Is Used as a Basis for Testing and Inspecting. By Ernst Mahle. Translated and edited by P. M. Heldt. Published in *Automotive Industries*, April 2, 1932, p. 523. **[E-1]**

The author describes tests for thermal qualities and wear resistance of piston materials, deals with various mechanical tests and illustrates the application of the results of the tests in piston design.

The tests described are completed by chemical, metallurgical and physical tests of the piston material itself and are asserted to be adequate for testing all piston materials and designs. Tests in the automobile engine, which are admittedly more expensive to conduct, are therefore said to be unnecessary.

The concluding part of the article appears in the April 9 issue of *Automotive Industries*.

Diesels with Precombustion Chamber Meet Broad Operating Problems. By Andrew Hornung. Published in *Automotive Industries*, April 30, 1932, p. 662. **[E-1]**

This article, covering specific problems of Diesel type-applications, is the third in a series appearing in *Automotive Industries* surveying the problems connected with the design and use of automotive Diesel engines.

Mr. Hornung discusses the differences in combustion characteristics of the two main types of solid-injection oil engine, that is, one having a precombustion chamber and the other having direct injection. The following conclusions are reached:

Where a highly reliable engine is required which must operate through a wide speed range and be insensitive to abuses in operation, such as are likely to occur in passenger motor-vehicles and in small stationary engines, precombustion-chamber engines should be adopted. On the other hand, direct-injection engines may be recommended in cases where expert operation may be expected and where the engine operates at fairly constant speed, as well as where a high mean effective pressure, high efficiency and low weight are essential, as in airplane engines, large stationary engines and so forth.

Diesel Connecting-Rod Stresses. By O. Thornycroft and B. C. Carter. Published in *Aircraft Engineering*, March, 1932, p. 69. **[E-1]**

In certain instances where Diesel-engine speeds above 2000 r.p.m. have been used, an unexpected amount of trouble in big-end bearing design has been encountered. Bearing areas and connecting-rod stiffness have been increased in the oil engine, as compared with the gasoline engine, the authors point out, so as to allow for the higher gas pressure in the former type; but, in spite of this, the white-metal linings in some engines have broken up in the course of long running.

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These observations, and in one design a connecting-rod fracture, led to an investigation of the dynamic conditions under which the connecting-rod works when gas pressure is very rapidly applied to the piston. Some notion of the rapidity of application of pressure is given when it is stated that, on the piston of a 4-in-bore oil engine running at 2000 r.p.m., a rate of pressure rise during combustion of no less than 4000 tons per sec. is not unusual. The duration of this rise of pressure may be 1/2000 sec., and the rise may be 350 lb. per sq. in. In oil engines in which combustion is very bumpy, the rate of pressure rise is often greater than in the example taken, whereas in the gasoline engine the rate is seldom more than one-half as great.

The effect of this rapid rise of cylinder pressure on connecting-rod loading is discussed and analyzed.

Effect of Fitting on Plain-Bearing Performance. By L. J. Bradford. Published in *Product Engineering*, April, 1932, p. 150. **[E-1]**

The performance of fitted bearings as compared with reamed bearings, and the importance of the shape of the clearance space to the performance of the bearing, are some of the questions that have been answered by test work conducted at the Pennsylvania State College laboratories and reported in this article.

From this research the conclusion is that, where speeds are high enough and loads low enough to permit the formation of a complete oil film, better performance can be expected of a bearing having a radius of curvature greater than that of the shaft than can be expected of the fitted bearing, unless the bearing extends around the shaft for only a short distance. This is said to be true both as regards friction and capacity. Where conditions are such that a complete oil film will not form, even when the proportions of the bearing and the viscosity of the lubricant are most favorable, the fitted bearing will give the better performance. This will, however, give far less satisfaction than if complete film lubrication had been obtainable. Finally, the initial clearance given bearings may well be increased considerably above that in common use today, thus shortening the time or perhaps entirely eliminating the necessity for a careful run-in at reduced loads and speeds.

Engine Bearings. By D. E. Anderson. Published in *Motive Power*, May, 1932, p. 8. **[E-4]**

In this paper, presented at the 1932 Annual Meeting of the Society, the author treats engine bearings from the manufacturer's point of view. He explains the different phases of engine operation and the vast number of factors that tend to shorten or to prolong the life of the bearing. Among those discussed are distribution of bearings, location of oil holes, operating temperatures, size and material of oil-pan, deflections in bearing mountings, crankshaft design, short bearings, material of bearings, crankcase-ventilating systems and centrifugally cast bearings versus die-cast bearings.

The article is published in two parts, the second appearing in the June issue of *Motive Power*.

The Control of Bearing Temperature in High-Speed Petrol Engines. By C. G. Williams. Published in *Engineering*, April 15, 1932, p. 464. **[E-4]**

Increased interest has been taken of late in oil coolers for both private and commercial motor-vehicles, a trend, according to the author, that is largely the result of higher and more sustained engine speeds.

The more obvious methods of reducing bearing temperatures in automobile engines are to lower the temperature of the oil supply and to increase the rate of oil circulation. The research reported in this paper was undertaken with the object of ascertaining the effectiveness of these methods, and, as a practical result of the investigation, a new method for controlling the oil-sump temperature was developed.

Theory would suffice to predict the influence of the two methods, according to the author, if it could be assumed that the frictional heat generated in a bearing is entirely dissipated by the oil. However, the experiments reported show that this assumption usually is unjustified, because a considerable portion of the frictional heat is dissipated by convection to the surrounding atmosphere, particularly from big-end bearings that are in rapid movement relative to the surrounding atmosphere.

The results of preliminary experiments suggested that, by circulating air through the crankcase, bearing temperatures could be limited very simply and effectively. Therefore further experiments were made to determine the possibilities and limitations of this method of temperature control when applied to a

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conventional automobile engine. Finally, it was conceived that, by arranging for automatic adjustment of the temperature of the air supplied to the crankcase, the oil temperature could be controlled within narrow limits under a wide range of operating conditions. The results of experiments in which the effectiveness of such an arrangement was tested are reported.

The paper is concluded in the April 29 issue of *Engineering*, p. 523.

MATERIAL

The Testing of Castings. By Walter Rosenhain. Paper presented before the Institute of Metals, London, March 9 and 10, 1932. [G-1]

This paper, which was the opening address for a general discussion on the subject, summarizes some of the principal points in regard to the testing of castings. Attention is confined to what is termed "specification testing" and "control testing," leaving aside investigatory testing. Ideal methods of non-destructive testing being as yet unavailable, the application of the usual mechanical tests to castings is considered. The use of chill-cast and sand-cast test-bars is discussed with special reference to the forthcoming adoption of a standardized sand-cast test-bar for the light alloys of aluminum. Reference is also made to the difficulty of determining small percentage elongations; and the author's suggestion that the practice followed in cast-iron testing, of using bending tests in which deflection is measured as a means of testing ductility, is described. The author further refers to discussion on the Testing of Cast Iron at the Zurich Congress of the New International Association for Testing Materials; and the author's summary of that discussion is given as an appendix to this paper.

In conclusion, the author discusses the value of tensile testing and the desirability of improving methods of testing in the interests of both the user and the manufacturer.

Elasticity of Phenolic Laminated Gears Offers Advantages in Timing-Train. By C. W. Mansur and H. M. Richardson. Published in *Automotive Industries*, April 23, 1932, p. 624. [G-1]

The timing drive on a modern automobile engine, to be satisfactory, according to the authors, should be: (*a*) accurate in its timing throughout its life, (*b*) quiet, (*c*) durable, (*d*) economical to produce and install and (*e*) light in weight.

In this article the authors show the present state of development in the design and application of non-metallic gears of the phenolic laminated type, describe tests designed to determine their structural and wearing qualities and point out how gears as used today fulfill the requirements of a good timing drive.

An Accelerated Test for the Determination of the Limiting Creep-Stress of Metals. By W. Barr and W. E. Bardgett. Published in *Engineering*, March 4, 1932, p. 293. [G-1]

The importance of the time factor in creep tests and the experimental difficulties involved in dealing with it are well known. Creep tests usually are based upon time-extension observations over prolonged periods on test pieces carrying constant loads at constant temperatures. In the form of accelerated test devised by the authors, the novel procedure adopted eliminates searching and enables the stress value to be obtained in a period of 48 hr. Simplicity of apparatus and ease of manipulation have been aimed at, and it is believed by the sponsors that the test offers many advantages in these respects.

Data on the Strength of Aircraft Materials. By Joseph S. Newell. Published in *Aviation Engineering*, March, 1932, p. 11. [G-1]

The recent trend toward all-metal structures for airplanes has brought with it the use of thin metal sheets for covering wings and fuselages and a desire on the part of designers to utilize such coverings as stress-carrying elements in the structure. Allowable stress data of engineering utility are almost non-existent for thin sheets carrying shear or compression loads, separately or in combination, the author asserts. Mathematical expressions based upon apparently sound assumptions are available for certain cases, but most of them are limited to prediction of the stress at which buckles first form. None, apparently, take account of the stress at which the buckles become permanent and none of the expressions indicate even approximately the maximum load or stress intensity that a sheet will resist. Therefore designers have been forced to make tests to cover each particular problm and, as a result, have accumulated data of little general utility.

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Notes and Reviews

Concluded

With a view toward the accumulation of more related data, a series of tests was conducted at the Massachusetts Institute of Technology to determine the maximum loads in compression or shear carried by various materials in arrangements adaptable to airplane design. The results are summarized in this article.

The Machinability of Steel as Indicated by Its Macrostructure. By F. E. Robinson and C. T. Nesbitt. Published in *Engineering*, March 25, 1932, p. 379. [G-1]

In an effort to discover an adequate index to the suitability of steel for gun barrels, that is, steel capable of being drilled uniformly, both as regards the finish obtained in the bore and the concentricity of the bore in relation to the outside diameter of the barrel, trials were undertaken which indicated the usefulness of the macrostructure method of specifying the steel.

This method of investigation was applied to other machining problems on bar materials, with a view to ascertaining whether macrostructure could be used as an index of the machining properties of steel. These further investigations, carried on over a period of two years, have produced results that have convinced the authors that macrostructure is a definite index of the machinability of steel.

No theory is advanced regarding the method whereby the best macrostructure of steel for machining purposes can be obtained, but all the evidence collected is said to indicate that the formation of the most suitable structure arises in the casting of the ingot and its treatment prior to rolling into billet form. The authors suggest that this is a problem which demands much closer attention from the steelmaker and metallurgist than has been given to it.

MISCELLANEOUS

Reducing Noise of Machines. By F. A. Firestone, F. M. Durbin and E. J. Abbott. Published in *Mechanical Engineering*, April, 1932, p. 271. [H-1]

With the growing demands for quieter machinery, the problem of noise inspection has become more prominent in the last few years than formerly.

The authors of this article explain that a soundmeter for routine factory inspection must meet requirements very different from those of one for use in the laboratory. Simplicity, speed, convenience of operation, ruggedness and freedom from the effects of extraneous noise and vibration are some of the essentials for a factory instrument that are not so important in the laboratory. In addition, the meter must give a correct inspection of the characteristics of the sound which it is desired to measure and must maintain its calibration over long periods. As these are rather difficult requirements to meet, the authors are of the opinion that some time will elapse before a general-purpose soundmeter that will satisfy them for most machine noises is developed.

The authors describe an investigation made at the University of Michigan to develop a soundmeter for routine noise inspection of cream separators for the International Harvester Co., which supported the project. The general methods of procedure and many of the problems involved are said to be virtually identical with those encountered in investigating a wide variety of machine noises.

The apparatus was installed in the Milwaukee plant of the company in the spring of 1928 and has been in continuous use since then, only minor repairs and adjustments having been necessary.

PASSENGER CAR

The Possibilities of the Unorthodox. By Maurice Platt. Published in *The Automobile Engineer*, April, 1932, p. 187. [L-1]

In this article on passenger cars, the author discusses many unorthodox modes of car construction in a broad comprehensive way, giving the sales value of the subject equal consideration with the technical features.

Under the heading of Minor Changes are considered (*a*) general style and appearance; (*b*) reliability and ease of maintenance; (*c*) road performance, including acceleration, braking, speed and controllability; (*d*) comfort, including quiet running, and (*e*) price or running costs.

The scope available for unorthodox ideas at present, according to the author, falls within five general classifications: streamlining, rear engine-location, front-wheel drive, novel transmissions and consistent springing. Present development in these aspects is reviewed and the hope is expressed that this paper will serve to stimulate new and original methods for the solution of old problems.